Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Empowered Autonomous)

Department of Zoology

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Phylum Cnidaria

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Cnidarian

coelenterate
Koilos = hollow ; enteron = intestine

Phylum Cnidarians comprises a diverse group of aquatic creatures, including jellyfish, corals, sea anemones, and hydras. These remarkable animals feature specialized cells called cnidocytes, which contain stinging structures called nematocysts.

❑ General Characters

1. Multicellular, with tissue grade of organisation.
2. They are aquatic, mostly marine and few are fresh water forms
3. They show radial symmetry and are diploblastic with blind-sac body plan.
   Animals exhibit two body forms. Polyp is cylindrical form (*Hydra*) and medusa is umbrella-like (*Aurelia* - Jelly fish).
4. They exhibit the phenomenon of **polymorphism** i.e occurence of different types of individuals or **zooids**. Zooids are mainly **Polyps** (sessile and asexual zooid) and **Medusae** (free swimming and sexual zooid).

5. Usually **carnivorous,** digestion **extracellular** as well as **intracellular**. Anus is absent.
6. Respiratory, circulatory and excretory systems are absent.
7. Reproduction takes place by both ways **asexual** (budding) and **sexual** (by formation of gametes).
8. **Alternation of generation (metagenesis)** takes place in which asexual polypoid generation alternates with sexual medusoid generation

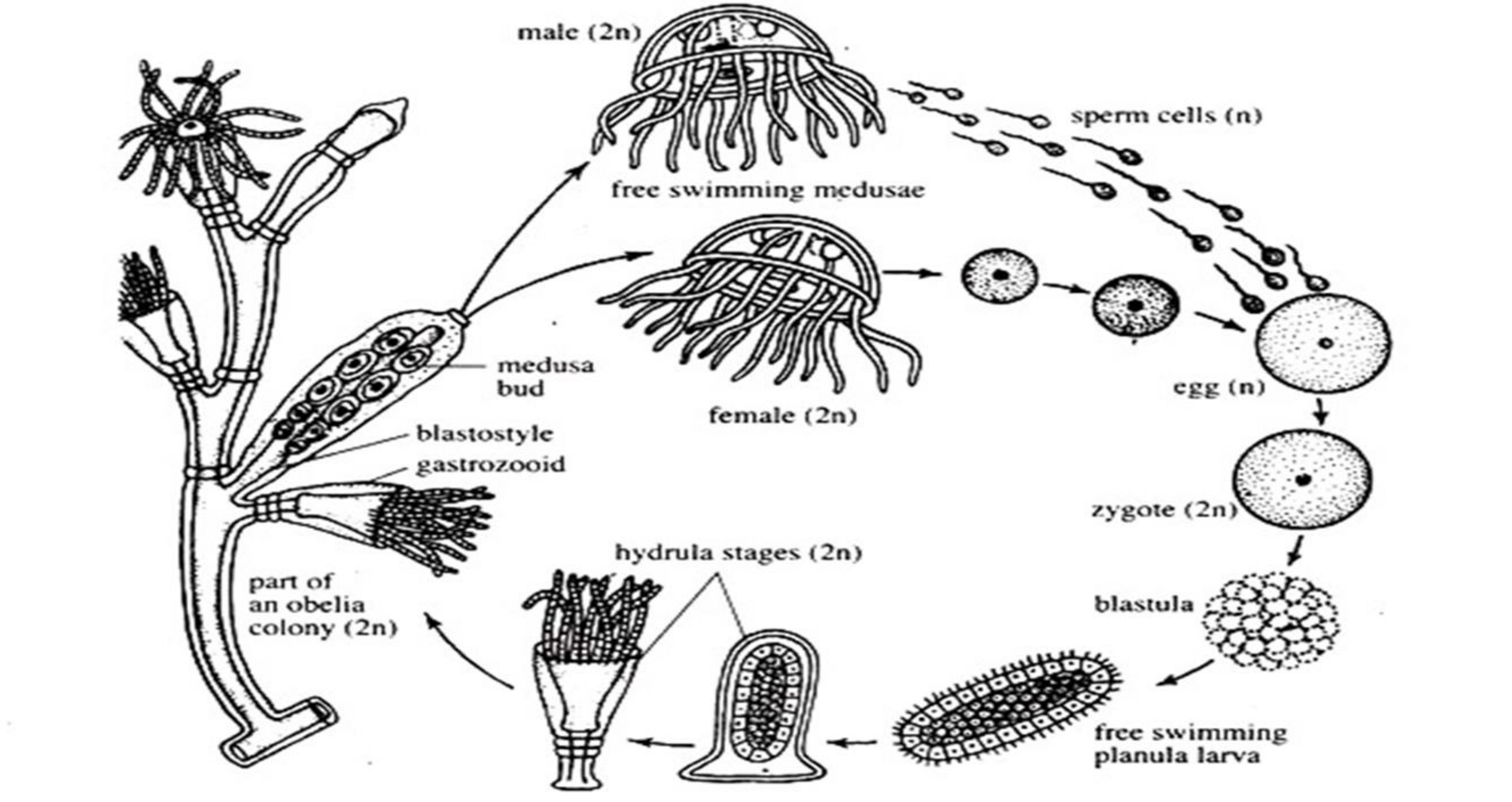
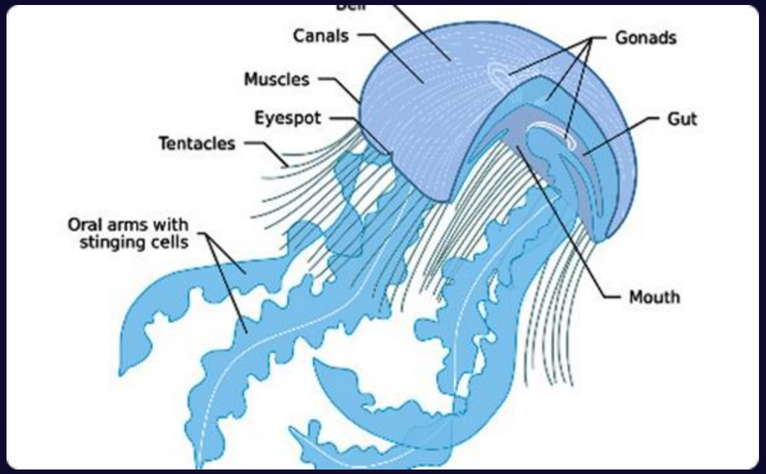


Fig. 2.89 : Life-history of *Obelia*. Note the presence of asexual and sexual phases in the life-history. The free-swimming medusae and planula larva assist in the dispersal.

Types of Cnidarians

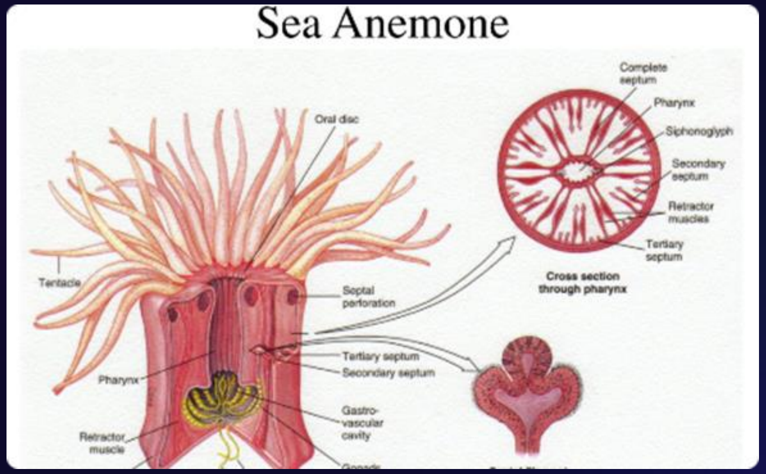


Jellyfish

Jellyfish, graceful creatures of the sea, drift through the ocean currents, displaying their mesmerizing tentacles.

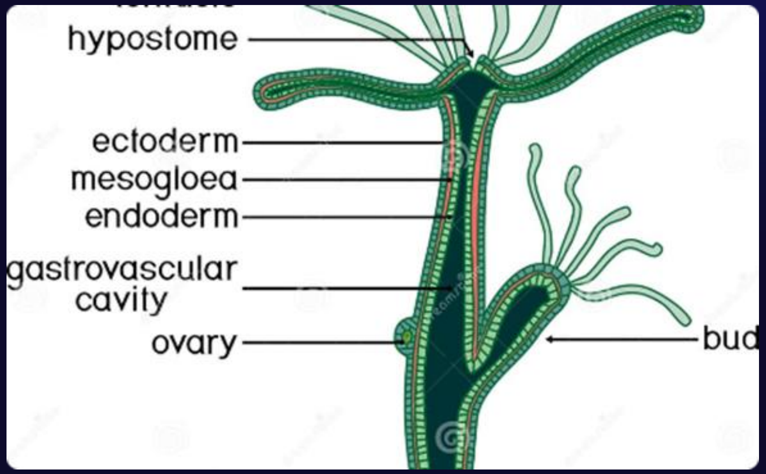
Corals

Coral reefs, bustling cities beneath the waves, are built by the tiny coral polyps that form intricate structures over thousands of years.



Sea Anemones

Sea anemones, sea's delicate flowers, sway in the current, showcasing their vibrant colors and symbiotic relationships.



Hydras

Hydras, small but mighty, can regenerate their entire body from just a fragment and are found in freshwater environments.

Ecological Importance

1 Marine Biodiversity

Cnidarians create habitats that support incredible marine biodiversity, serving as homes and feeding grounds for countless organisms.

2 Coral Reef Protection

Coral reefs formed by cnidarians act as natural barriers, protecting coastlines from erosion caused by ocean waves and storms.

3 Nutrient Cycling

Through filter-feeding or symbiotic relationships, cnidarians contribute to the balance of marine ecosystems by maintaining nutrient levels.

4 Scientific Research

Cnidarians provide vital insights into biological processes, neurobiology, and genetics, advancing our understanding of life itself.

THANK YOU

Ultrastructure of Neuron

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Introduction

Understanding the ultrastructure of neurons provides insights into their complex organization and functionality in the nervous system.

Components of a Neuron

Cell Body

The central part of a neuron containing the nucleus and other organelles essential for the cell's survival and functioning.

Dendrites

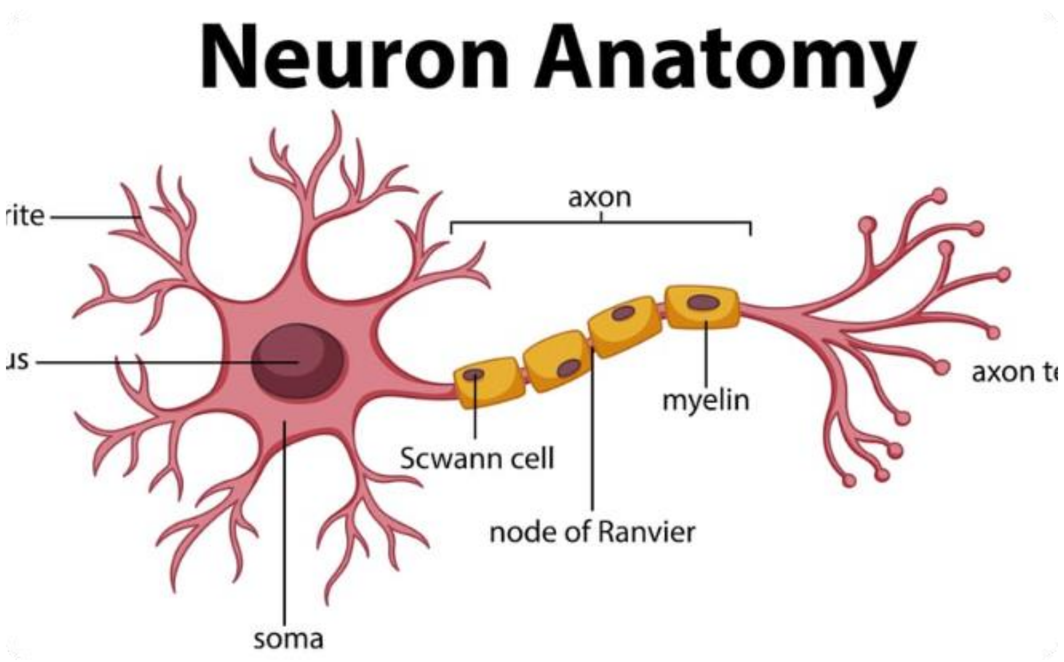
Branch-like structures that receive signals from other neurons and transmit them towards the cell body.

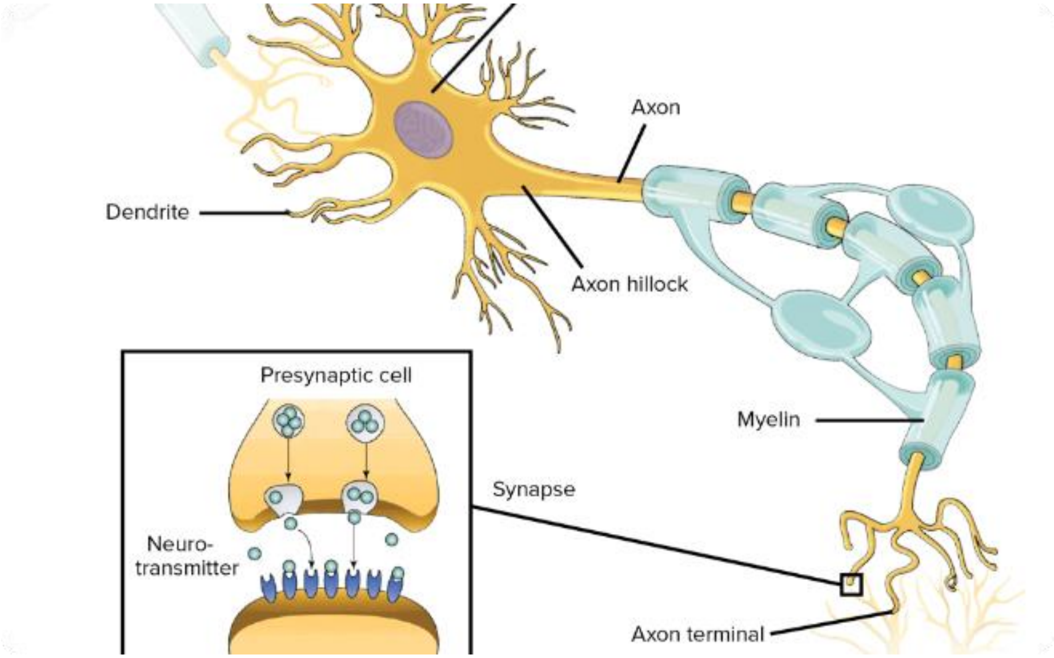
Axon Hillock and Initial Segment

The region where the axon originates and generates action potentials, crucial for signal propagation.

Axon

The long, slender projection responsible for the transmission of signals away from the cell body to other neurons or target tissues. Let's explore its fascinating features!





Axon Structure

The axon consists of a single long process with specialized regions such as the axon hillock, initial segment, and axon terminals.

Axon Function

It carries electrical impulses, known as action potentials, to communicate information across the nervous system.

Myelin Sheath and Nodes of Ranvier

1

Myelin Sheath

A fatty, insulating layer formed by glial cells (oligodendrocytes in the central nervous system and Schwann cells in the peripheral nervous system) that wraps around the axon.

2

Nodes of Ranvier

Small gaps between adjacent myelin segments where the axon is exposed, facilitating the efficient propagation of electrical impulses.

3

Function

The myelin sheath and nodes of Ranvier collectively enhance the speed and efficiency of signal transmission along the axon.

Terminal Boutons or Axon Terminals

These specialized structures located at the distal end of the axon are crucial for transmitting signals to other neurons or target tissues.

1. ## Synaptic Vesicles

   Membrane-bound sacs containing neurotransmitters, chemical messengers that transmit signals across the synapse.

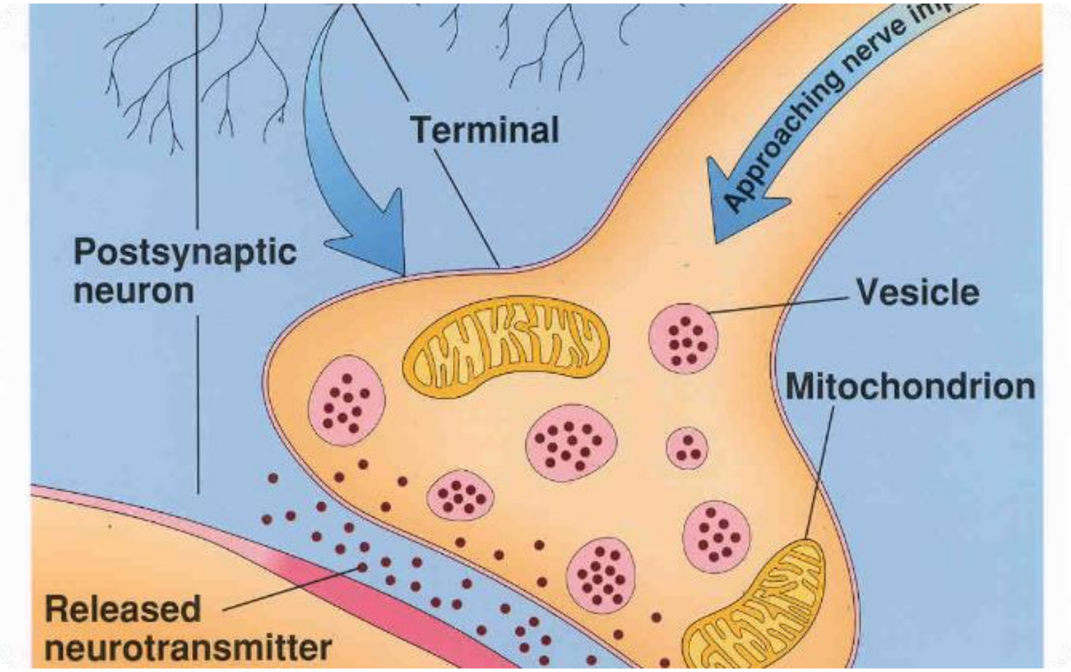
2. ## Presynaptic Membrane

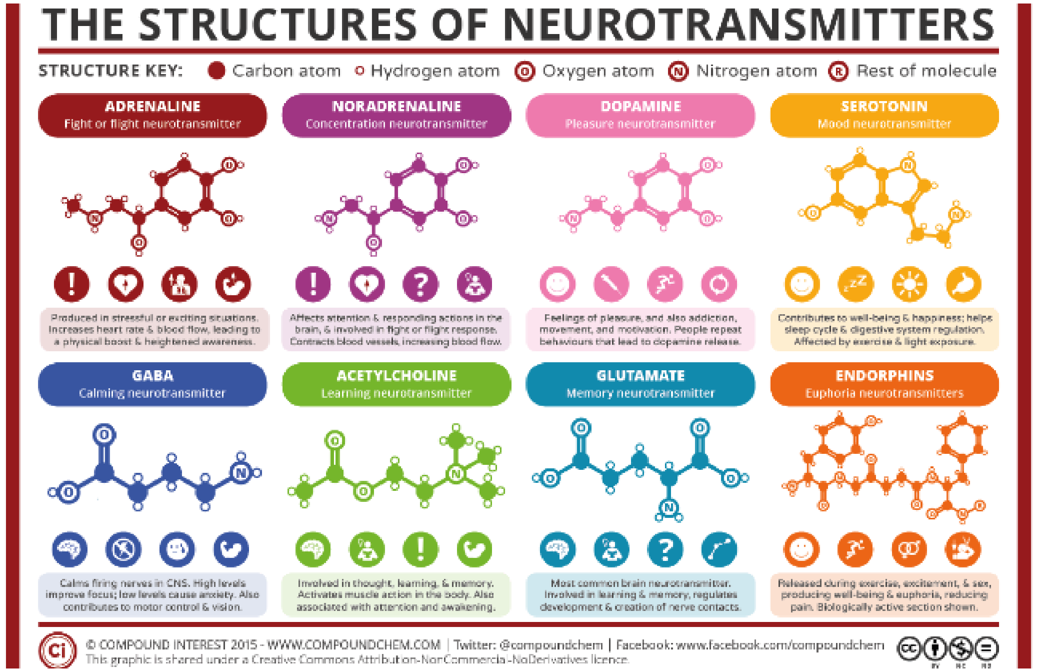
   The membrane of the terminal bouton that releases neurotransmitters into the synapse.

3. ## Postsynaptic Membrane

   The membrane of the target neuron's dendrite or cell body that receives neurotransmitters and initiates a response.

Synapses and Neurotransmitters





Synapse Structure

A specialized junction between the terminal bouton of one neuron and the dendrite or cell body of another neuron.

Neurotransmitters

Chemicals released by the presynaptic neuron that bind to receptors on the postsynaptic neuron, triggering electrical impulses and signal transmission.

THANK YOU

Action Potential

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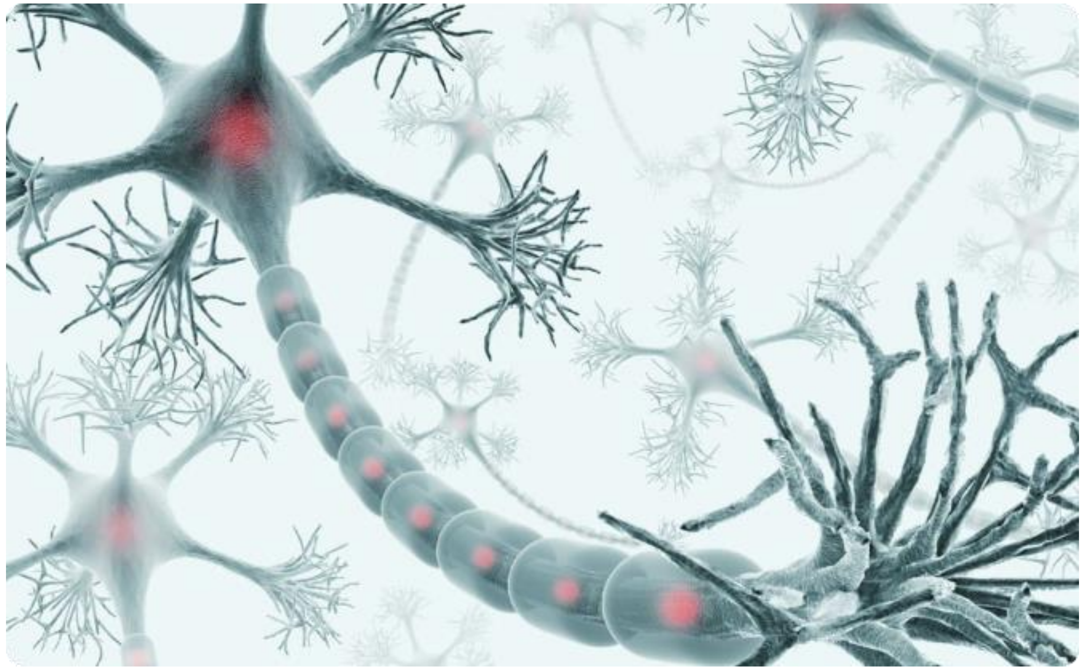
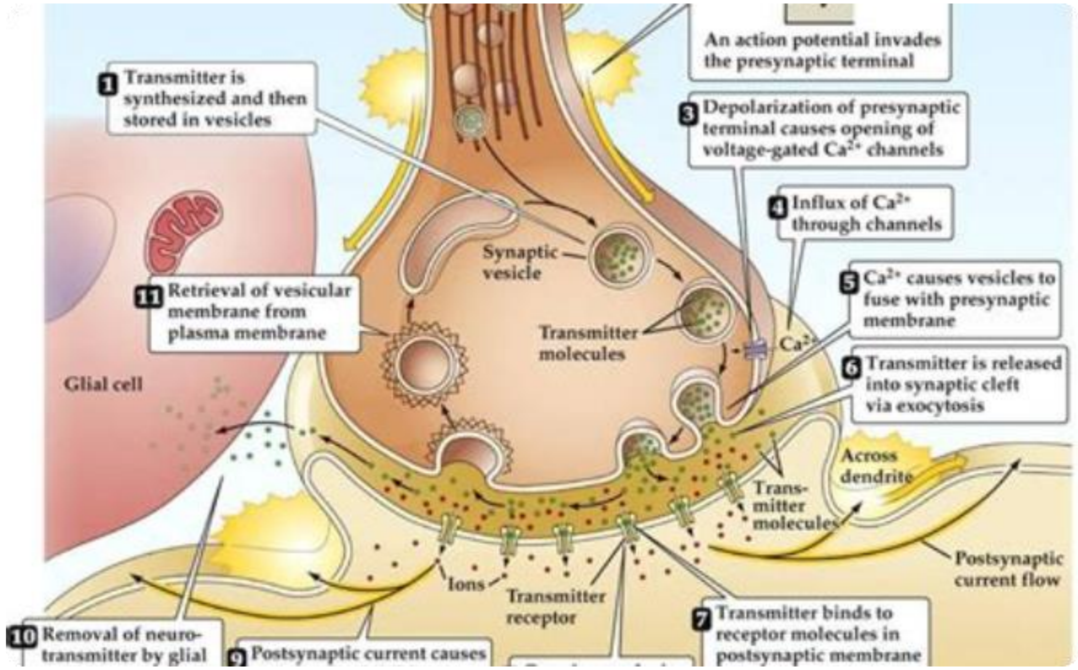
What is Action Potential?





Definition

Action potential is an electrical signal that is transmitted along the axon of a neuron when it is stimulated.

Membrane Potential

At rest, the inside of the neuron is negative compared to the outside. This difference in charge is called the membrane potential.

The Process of Action Potential

Resting State

The neuron is at rest, with a stable membrane potential of -70mV. The sodium-potassium pump maintains the ion gradient across the membrane.

Depolarization Phase

A stimulus causes the membrane potential to become less negative. When it reaches the threshold of -55mV, voltage-gated sodium ion channels open, leading to depolarization of the membrane.

Threshold and All-Or-None Principle

Once the threshold is reached, action potential fires. It is an all-or-none response, meaning that it either happens completely or not at all.

Propagation of Action Potential

The depolarization wave spreads along the neuron as sodium ions rush in and potassium ions rush out. This leads to the opening and closing of ion channels along the axon.

Repolarization and Refractory Period

1
Repolarization

Once the depolarization wave passes, potassium channels open, and potassium rushes out of the neuron, causing repolarization of the membrane.

2
Refractory Period

The neuron is temporarily unable to fire another action potential due to the refractory period. This ensures that the signal moves in one direction and prevents backfiring.

Action Potential in Action

Step 1 **1**

A stimulus, such as light, sound, or a touch, excites a sensory neuron.

Step 2 **2**

The sensory neuron fires an action potential, which travels to the spinal cord.

Step 3 **3**

The action potential synapses with a motor neuron in the spinal cord.

Step 4 **4**

The motor neuron fires an action potential, which travels to a muscle, causing it to contract.

Action Potential in Health and Disease

Alzheimer's Disease

Alzheimer's is characterized by a progressive loss of neurons that affects memory, behavior, and thinking. Research has shown that this disease alters the way that neurons fire action potentials.

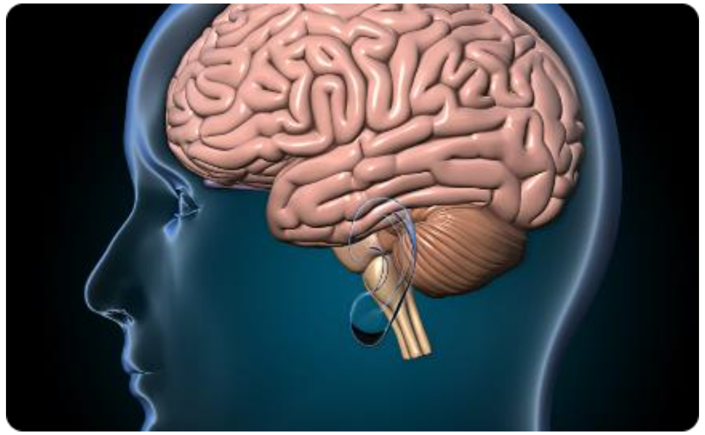
Epilepsy

Epilepsy is a neurological disorder characterized by recurrent seizures. Seizures can be caused by abnormal firing of action potentials in the brain.

Heart Function

The heart is a muscle that relies on action potentials to beat. Dysfunction in the ion channels that affect the action potential can lead to irregular heartbeats or arrhythmias.

Action Potential and Learning



Memory

Memory relies on the strengthening and weakening of connections between neurons, which are influenced by the repetition of action potentials.

Neuroplasticity

The ability of the brain to change and adapt is called neuroplasticity. Firing action potentials plays a key role in the process of rewiring and reorganizing the brain.

Early Development

The generation and coordination of action potentials in the brain are crucial for children's learning and development. Understanding how action potentials work can help us improve educational strategies.

THANK YOU

Ultrastructure of Skeletal Muscle

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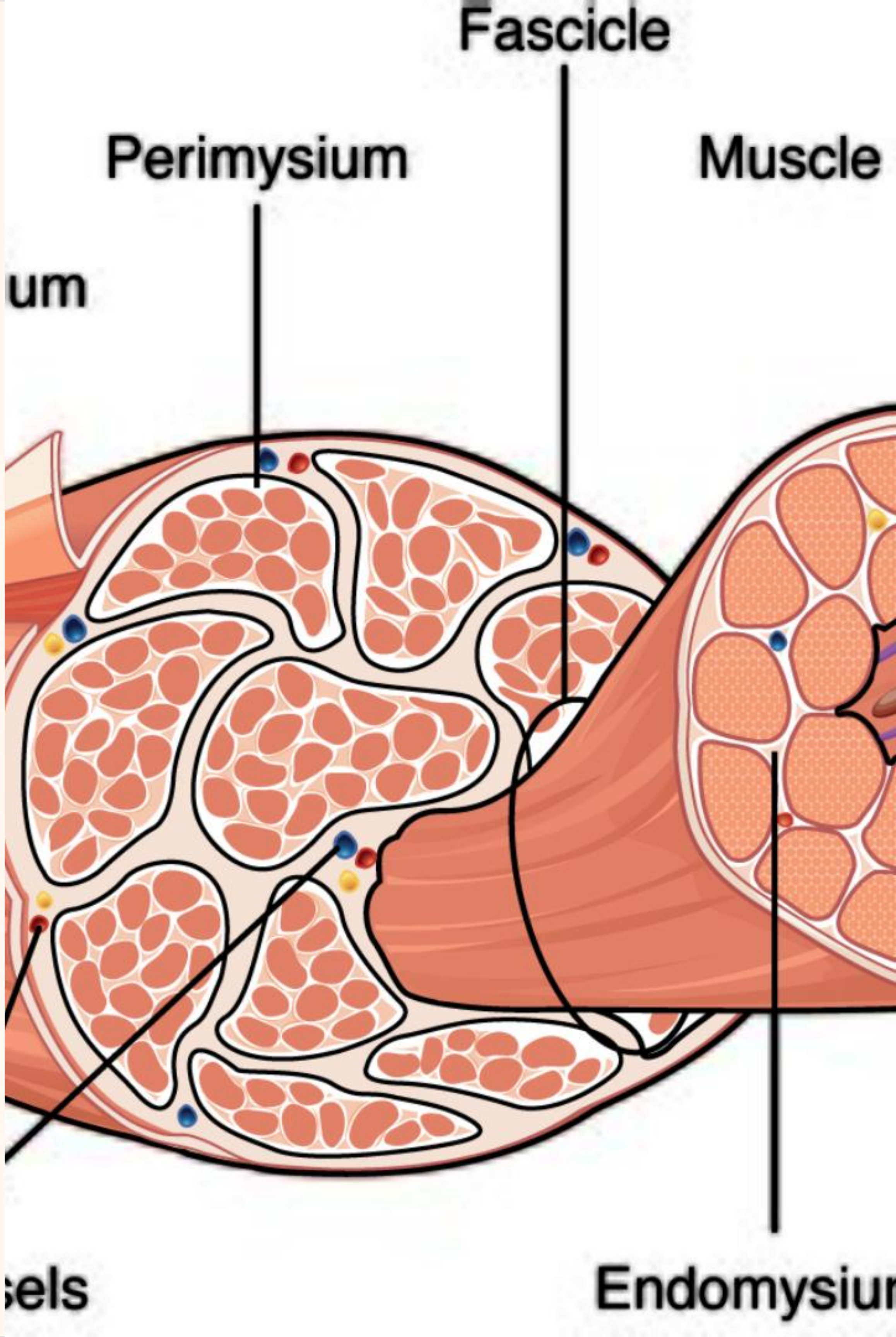


Muscle

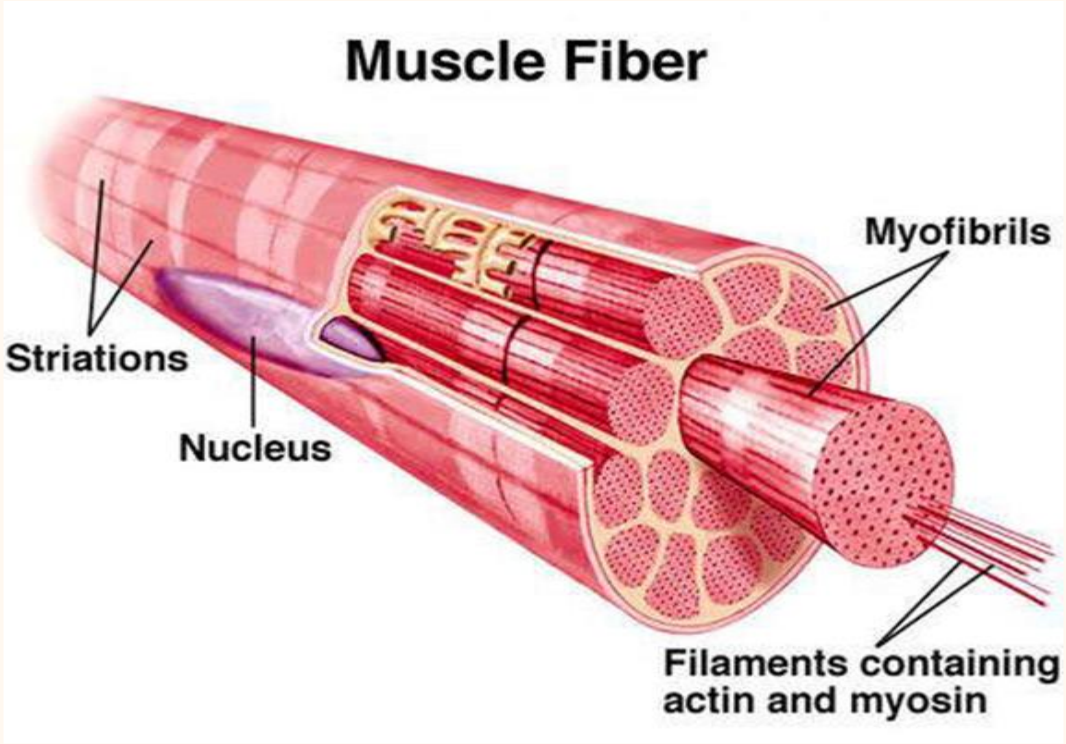
Latin word “musculus” which means little mouse. It is named so because of the movement of muscle under the skin resembles a running mouse.

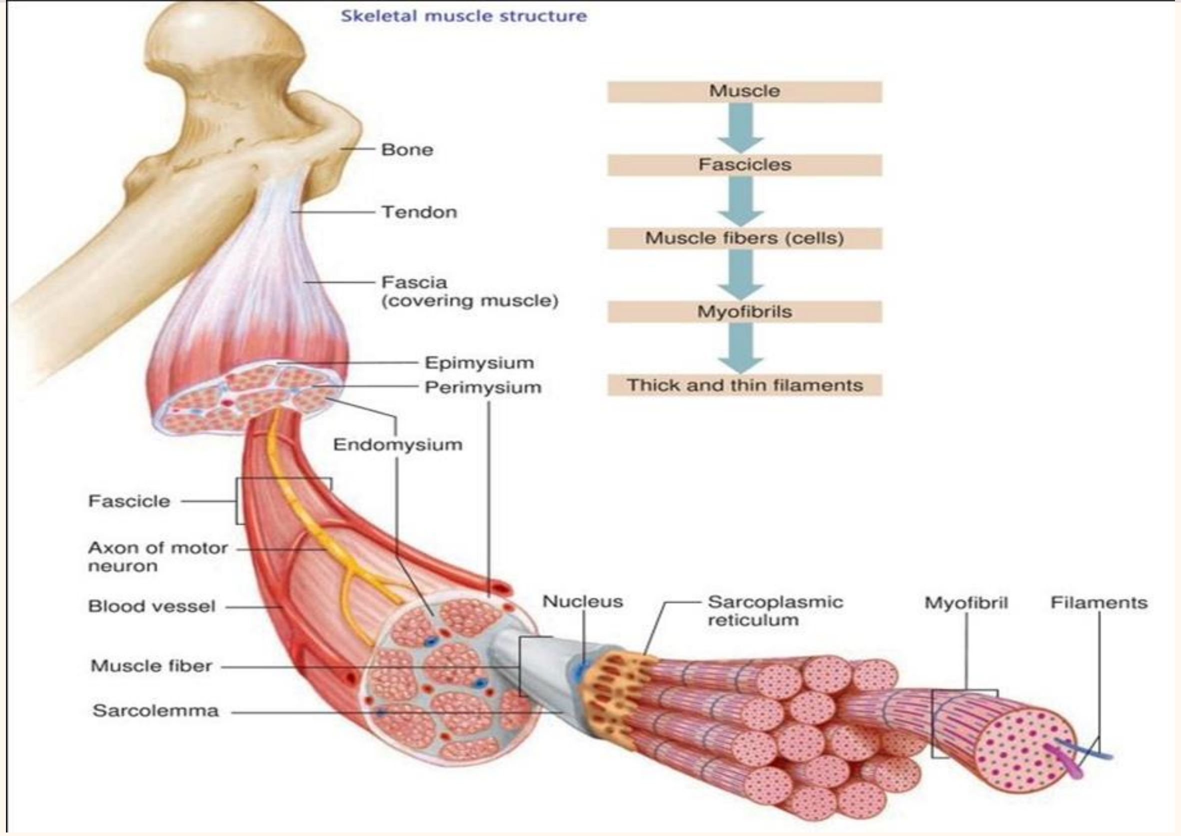
Joints make a skeleton potentially movable and bones provides a basic system of levers but bones and joints cannot move by themselves. The driving force behind the movement is the muscle.
There are three types of muscles

Smooth muscle
Cardiac muscle
Skeletal muscle

Muscle Composition

Skeletal muscles are made up of muscle fibers, connective tissue, blood vessels, and nerves. These components work together to facilitate movement and provide support.





Sarcomeres and Myofibrils

Sarcomeres, the basic units of muscle contraction, are made up of thick myosin filaments and thin actin filaments. These filaments slide past each other during contraction, shortening the sarcomere length.

Role of Actin and Myosin

1. **Actin**

   Actin filaments provide the structure and flexibility necessary for muscle contraction.

2. **Myosin**

   Myosin filaments contain cross-bridges that interact with actin during muscle contraction.

3. **Interaction**

   The sliding movement of actin and myosin filaments generates muscle force.

T-Tubules and Sarcoplasmic Reticulum

1

T-Tubules

T-Tubules are invaginations of the muscle cell membrane that allow for rapid transmission of electrical signals.

2

Sarcoplasmic Reticulum

The sarcoplasmic reticulum stores and releases calcium ions, which are crucial for muscle contraction.

3

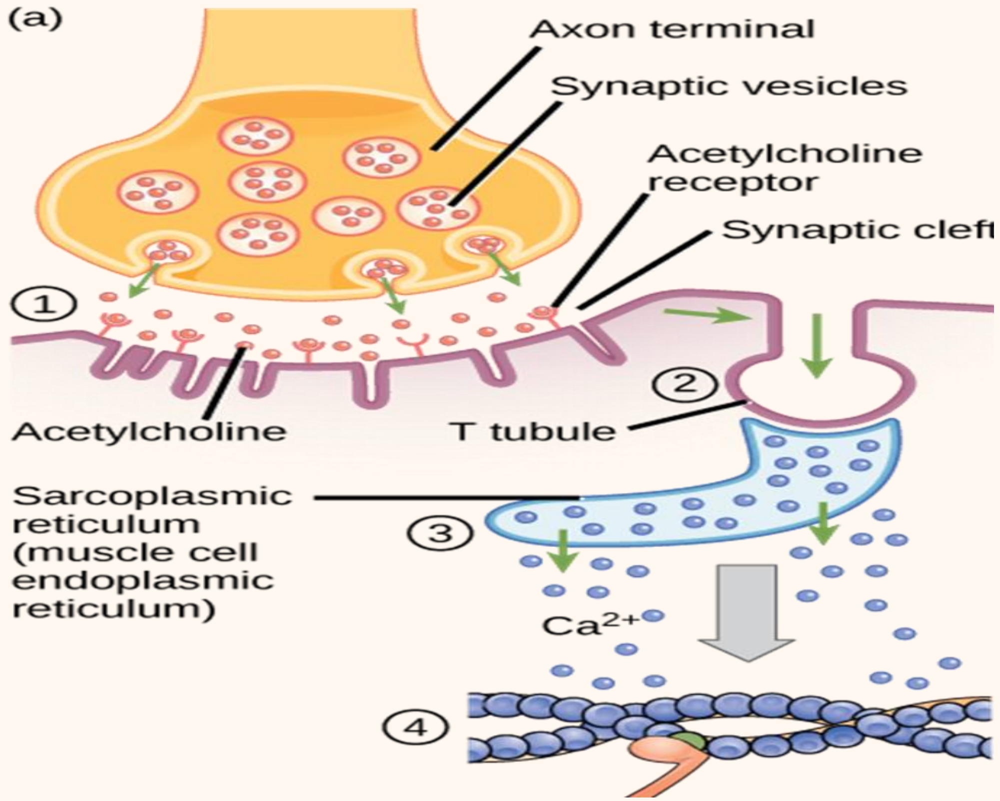
Interaction

The T-tubules and sarcoplasmic reticulum work together to ensure efficient muscle excitation and contraction.

Motor Unit and Neuromuscular Junction

Motor Unit

A motor unit consists of a motor neuron and the muscle fibers it innervates.



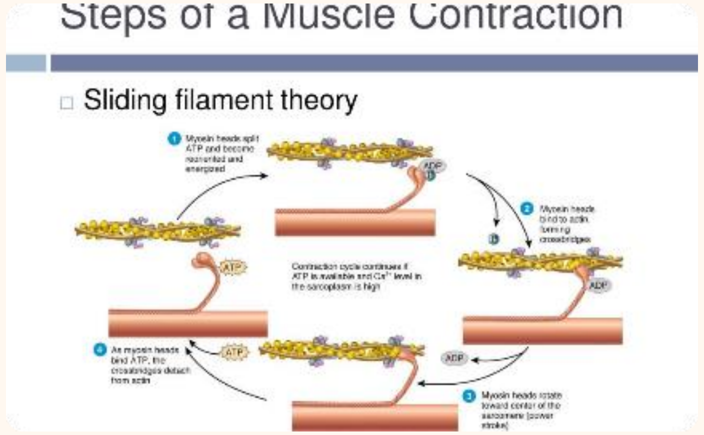
Neuromuscular Junction

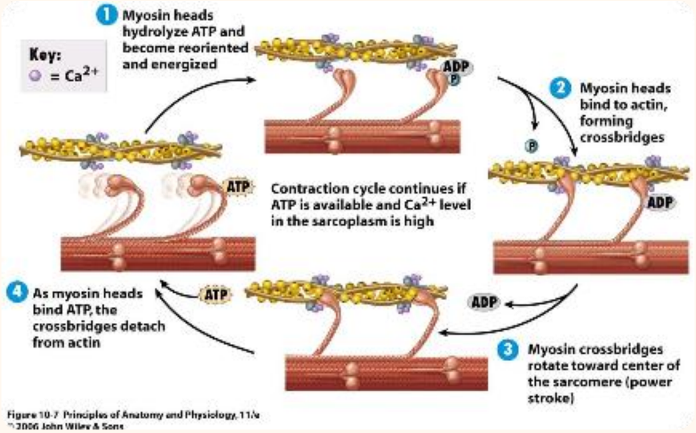
The neuromuscular junction is the point where the motor neuron and muscle fiber meet, allowing for communication and muscle activation.

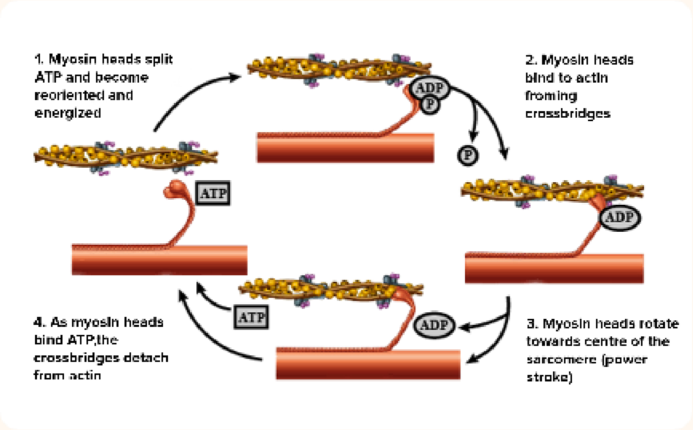
Signal Transmission

The motor neuron releases neurotransmitters, stimulating muscle fiber contraction at the neuromuscular junction.

Muscle Contraction Process







Cross-Bridge Cycling

During muscle contraction, myosin cross-bridges repeatedly bind to actin, pivot, and detach, generating force and sliding the actin filaments.

ATP Breakdown

ATP provides energy for muscle contraction. ATP is hydrolyzed into ADP and inorganic phosphate, releasing energy for cross-bridge cycling.

Calcium Release

Calcium ions are released from the sarcoplasmic reticulum, binding to troponin and triggering a series of events that expose binding sites on actin.

THANK YOU